CLAIMS

What is claimed is:

1. A self-resonant spiral resonator comprising a high temperature superconductor line oriented in a spiral fashion such that adjacent lines of the spiral resonator are spaced from each other by a gap distance that is less than the line width of the high temperature superconductor line and so as to provide a central opening within the spiral resonator,

wherein the gap distance is varied by utilizing at least two different gap distances such that the gap distance in an outer portion of the spiral resonator is greater than the gap distance in an inner portion of the spiral resonator, and

wherein the dimensions of the central opening are approximately equal to the gap distance in an inner portion of the spiral resonator.

2. The self-resonant spiral resonator of Claim 1 wherein the self-resonant spiral resonator has a shape selected from the group consisting of rectangular, rectangular with rounded corners, polygonal with more than four sides and circular.

3. The self-resonant spiral resonator of Claim 1 further comprising a conductive tuning pad disposed in the central opening of the self-resonant spiral resonator.

4. The self-resonant spiral resonator of Claim 1 wherein the high temperature superconductor used to form the high temperature superconductor line is selected from the group consisting of $YBa_2Cu_3O_7$, $Tl_2Ba_2CaCu_2O_8$, $TlBa_2Ca_2Cu_3O_9$, $(TlPb)Sr_2CaCu_2O_7$ and $(TlPb)Sr_2Ca_2Cu_3O_9$.

5. The self-resonant spiral resonator of Claim 1 wherein the self-resonant spiral resonator is on a substrate selected from the group consisting of $LaAlO_3$, MgO, $LiNbO_3$, sapphire and quartz.

6. The self-resonant spiral resonator of Claim 1 wherein the gap distance is varied by utilizing two different gap distances d_1 and d_2 such that d_1 is the gap distance over an outer portion of the spiral resonator and d_2 is the gap distance over an inner portion of the spiral resonator; and

wherein the gap distance d_1 is the gap distance for about 25% to about 75% of the length of the spiral of the spiral resonator, and the gap distance d_2 is the gap distance over the remaining portion of the length of the spiral of the spiral resonator.

7. The self-resonant spiral resonator of Claim 7 wherein the gap distance d_1 is the gap distance for about 50% of the length of the spiral of the spiral resonator, and the gap distance d_2 is the gap for about 50% of the length of the spiral of the spiral resonator.

8. The self-resonant spiral resonator of Claim 1 wherein the gap distance is varied by utilizing two different gap distances d_1 and d_2 such that d_1 is the gap distance over an outer portion of the spiral resonator and d_2 is the gap distance over an inner portion of the spiral resonator; and

wherein the gap distance d_1 and the gap distance d_2 are each less than half of the line width of the high temperature super conductor line.

9. The self-resonant spiral resonator of Claim 1 wherein the gap distance is varied by utilizing at least three different gap distances.

10. The self-resonant spiral resonator of Claim 9 wherein each gap distance is less than half of the line width of the high temperature super conductor line.

11. A high temperature superconductor mini-filter comprising at least two self-resonant spiral resonators wherein each of the self-resonant spiral resonators is independently a self-resonant spiral resonator according to Claims 1, 6, 8, 9 and 10.

12. The high temperature superconductor mini-filter of Claim 11 further comprising

(a) a substrate having a front side and a back side wherein each self-resonant spiral resonator is disposed on the front side of the substrate;

(b) at least one inter-resonator coupling;

(c) an input coupling circuit comprising a transmission line with a first end thereof connected to an input connector of the filter and a second end thereof coupled to a first one of the self-resonant spiral resonators;

(d) an output coupling circuit comprising a transmission line with a first end thereof connected to an output connector of the filter and a second end thereof coupled to a last one of the self-resonant spiral resonators;

(e) a blank high temperature superconductor film disposed on the back side of the substrate as a ground plane; and

(f) a conductive film disposed on the blank high temperature superconductor film.

13. The high temperature superconductor mini-filter of Claim 12 wherein the conductive film is a gold film.

14. The high temperature superconductor mini-filter of Claim 12 wherein the conductive film serves as a contact to a case of the mini-filter.

15. The high temperature superconductor mini-filter of Claim 12 further comprising

(g) a superstrate having a front side and a back side, wherein the front side of the superstrate is positioned in intimate contact with the self-resonant spiral resonators disposed on the front side of the substrate;

(h) a second blank high temperature superconductor film disposed on the back side of the superstrate as a ground plane; and

(i) a second conductive film disposed on the surface of the second high temperature superconductor film.

16. The high temperature superconductor mini-filter of Claim 15 wherein the conductive film and the second conductive film are gold films.

17. The high temperature superconductor mini-filter of Claim 15 wherein the conductive film and the second conductive film serve as contacts to a case of the mini-filter.

18. A high temperature superconductor mini-multiplexer comprising at least two mini-filters,

wherein each mini-filter has a frequency band that is different from and does not overlap with the frequency band of each other mini-filter;

wherein each mini-filter comprises at least two self-resonant spiral resonators; and

wherein each of the self-resonant spiral resonators in each of the mini-filters is independently a self-resonant spiral resonator according to Claims 1, 6, 8, 9 and 10.

19. The high temperature superconductor mini-multiplexer of Claim 18 further comprising

(a) a distribution network with one common port as an input for the mini-multiplexer and multiple distributing ports, wherein a respective distributing port is connected to an input of a corresponding mini-filter; and

(b) a multiple of output lines, wherein a respective output line is connected to an output of a corresponding mini-filter.

20. A cryogenic receiver front end comprising at least one mini-filter according to Claim 11.